



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/736,128	12/15/2003	Carl Steven Gifford	10001-37708	3616
2574	7590	02/07/2007	EXAMINER	
JENNER & BLOCK, LLP ONE IBM PLAZA CHICAGO, IL 60611			TU, JULIA P	
			ART UNIT	PAPER NUMBER
			2611	
SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE		
3 MONTHS	02/07/2007	PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

SF

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/736,128	GIFFORD ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Julia P. Tu	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

1) Responsive to communication(s) filed on 15 December 2003.  
 2a) This action is FINAL.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

4) Claim(s) 12-29 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 12-14, 18-20, 22, 23, 26 and 28 is/are rejected.  
 7) Claim(s) 15-17, 21, 24, 25, 27, 29 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 15 December 2003 is/are: a) accepted or b) objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
     1. Certified copies of the priority documents have been received.  
     2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
     3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)	5) <input type="checkbox"/> Notice of Informal Patent Application
Paper No(s)/Mail Date _____	6) <input type="checkbox"/> Other: _____

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rashid-Farrokh et al. (US 6,304,750) in view of Smolyar et al. (US 2002/0061056) and Song (US 6,987,746).

As shown in figure 1, Rashid-Farrokh discloses a diversity signal combiner system for a digital communications system, comprising:

a plurality of channels each for receiving a channel signal of a plurality of channel signals from a spatially diverse antenna array element (151 in figure 1);  
a plurality of downconverters each on one of the plurality of channels for downconverting a corresponding channel signal to baseband (153 in figure 1);  
a combiner for combining the plurality of channel signals by weighting and delaying each of the plurality of channel signals (165, 169 in figure 1, column 3, lines 3-21); and

Rashid-Farrokh discloses all of the subject matter above but does not explicitly teach a co-phasing software block for resolving phase differences among the plurality of

channel signals after the plurality of channel signals are downconverted by the plurality of downconverters.

However, the plurality of channel signals need to have phase alignment prior to combining is well known in the art as it is evident by Smolyar (page 1, paragraph [0006]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of Smolyar into the teaching of Rashid-Farrokh in order to obtain diversity gain as well as to improve the communication performance.

Rashid-Farrokh and Smolyar teach all of the above subject matters except for a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals to enable a system signal to be accurately demodulated to accurately represent transmitted data.

However, Song discloses a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals to enable a system signal to be accurately demodulated to accurately represent transmitted data (column 7, lines 38-42).

It is desirable to include a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals in order to provide accurate synchronization (column 6, lines 61-62). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the symbol synchronizer which includes a single complex sliding window matched filter for filtering the plurality of channel signals with a match

filtering function as taught by Song into the system as taught by Rashid-Farrokhi and Smolyar so as to improve the transmission quality.

3. Claims 13 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rashid-Farrokhi et al. (US 6,304,750) in view of Smolyar et al. (US 2002/0061056) and Song (US 6,987,746) and further in view of Smart et al. (US 2002/0041637).

(1) with regard to claim 13:

Rashid-Farrokhi, Smolyar, and Song disclose all of the subject matters in claim 12 above except for the symbol synchronizer includes a single complex sliding window matched filter for filtering the plurality of channel signals with a match filtering function based on predetermined signal transfer function characteristics to average noise out of the plurality of channel signals and thereby maximize a signal-to-noise ratio of each of the plurality of channel signals.

However, Smart discloses the symbol synchronizer includes a single complex sliding window matched filter for filtering the plurality of channel signals with a match filtering function (page 14, paragraph [0191], also see figures 15, 19, and 20).

It is desirable to have the symbol synchronizer which includes a single complex sliding window matched filter for filtering the plurality of channel signals with a match filtering function in order to reduce peak-to-average power ratio as well as to improve the bandwidth efficiency of the communication system (page 1, paragraph [0003]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the symbol synchronizer which includes a single complex

sliding window matched filter for filtering the plurality of channel signals with a match filtering function as taught by Smart into the system as taught by Rashid-Farrokh, Smolyar, and Song to improve the bandwidth efficiency of the communication system (page 1, paragraph [0003]).

(2) with regard to claim 18:

Smart further teaches the single complex sliding window matched filter is connected to the symbol synchronizer via a closed feedback loop to provide a variable step size for fast delay, channel and phase estimate convergence performance (see figure 15)

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rashid-Farrokh et al. (US 6,304,750) in view of Smolyar et al. (US 2002/0061056) and Song (US 6,987,746) further in view of Smart et al. (US 2002/0041637) and further in view of Koch (5,297,171).

Rashid-Farrokh, Smolyar, Song, and Smart disclose all of the above subject matters except for an equalizer for receiving the plurality of channel signals from the combiner, for providing channel estimates of complex channel gain when necessary, and for removing channel effects from the plurality of channel signals before the plurality of channel signals are input into the single complex sliding window matched filter.

However, Koch discloses an equalizer for receiving the plurality of channel signals from the combiner (block 3 in figure 1).

It is desirable to include an equalizer for receiving the plurality of channel signals from the combiner provide diversity gain as well as to improve signal to noise ratio. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to an equalizer for receiving the plurality of channel signals from the combiner as taught by Koch into the system as taught by Rashid-Farrokhi, Smolyar, Song, and Smart to improve the transmission quality (column 2, lines 7-8).

5. Claims 19, 20, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rashid-Farrokhi et al. (US 6,304,750) in view of Smolyar et al. (US 2002/0061056) and Song (US 6,987,746) and further in view of Dabak et al. (US 2004/0190603).

(1) with regard to claim 19:

As shown in figure 1, Rashid-Farrokhi discloses a diversity signal combiner system for a digital communications system, comprising:

a plurality of channels each for receiving a channel signal of a plurality of channel signals from a spatially diverse antenna array element (151 in figure 1);

a plurality of downconverters each on one of the plurality of channels for downconverting a corresponding channel signal to baseband (153 in figure 1);

a combiner for combining the plurality of channel signals by weighting and delaying each of the plurality of channel signals (165, 169 in figure 1, column 3, lines 3-21); and

Rashid-Farrokhi discloses all of the subject matter above but does not explicitly teach a co-phasing software block for resolving phase differences among the plurality of channel signals after the plurality of channel signals are downconverted by the plurality of downconverters.

However, the plurality of channel signals need to have phase alignment prior to combining is well known in the art as it is evident by Smolyar (page 1, paragraph [0006]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of Smolyar into the teaching of Rashid-Farrokhi in order to obtain diversity gain as well as to improve the communication performance.

Rashid-Farrokhi and Smolyar teach all of the above subject matters except for a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals to enable a system signal to be accurately demodulated to accurately represent transmitted data.

However, Song discloses a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals to enable a system signal to be accurately demodulated to accurately represent transmitted data (column 7, lines 38-42).

It is desirable to include a symbol synchronizer for determining symbol boundaries of the plurality of channel signals after the combiner combines the plurality of channel signals in order to provide accurate synchronization (column 6, lines 61-62). Therefore, it would have been obvious to one of ordinary skill in the art at the time the

invention was made to have the symbol synchronizer which includes a single complex sliding window matched filter for filtering the plurality of channel signals with a match filtering function as taught by Song into the system as taught by Rashid-Farrokhi and Smolyar so as to improve the transmission quality.

Rashid-Farrokhi, Smolyar, and Song disclose all of the above subject matters except for a plurality of matched filters each being located on one of the plurality of channels for filtering the corresponding plurality of channel signals with a match filtering function based on predetermined signal transfer function characteristics to average noise out of the corresponding plurality of channel signals to maximize a signal-to-noise ratio of each of the plurality of channel signals.

However, Dabak teach a plurality of matched filters each being located on one of the plurality of channels for filtering the corresponding plurality of channel signals with a match filtering function based on predetermined signal transfer function characteristics to average noise out of the corresponding plurality of channel signals to maximize a signal-to-noise ratio of each of the plurality of channel signals (see matched filters in figure 7).

It is desirable to include a plurality of matched filters each being located on one of the plurality of channels for filtering the corresponding plurality of channel signals with a match filtering function in order to provide a reduced bit error rate (page 4, paragraph [0039]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a plurality of matched filters each being located on one of the plurality of channels for filtering the corresponding plurality of channel

signals with a match filtering function as taught by Dabak into the system as taught by Rashid-Farrokh, Smolyar, and Song in order to provide a reduced bit error rate and better performance to the communication system.

(2) with regard to claim 20:

Rashid-Farrokh further teaches an adaptive delay/phase updater for receiving digitally sampled signals from a variable delay in each of the plurality of channels (see blocks 157 (delay elements) in figure 1).

(3) with regard to claim 22:

Rashid-Farrokh further teaches the adaptive phase/delay updater is connected to each of the plurality of downconverters via respective output for adjusting respective downconverters oscillator sampling frequencies and sampling phases, and for providing a delay in each of the plurality of channels (see blocks 157 (delay elements) in figure 1).

6. Claims 23, 26, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rashid-Farrokh et al. (US 6,304,750) in view of Smolyar et al. (US 2002/0061056) and Song (US 6,987,746) and further in view of Dabak et al. (US 2004/0190603) and further in view of Koch (5,297,171).

(1) with regard to claim 23:

Rashid-Farrokh, Smolyar, Song, and Smart disclose all of the above subject matters except for an equalizer for receiving the combined channel signals from the combiner and for providing combiner weight updating on the plurality of channel signals.

However, Koch discloses an equalizer for receiving the plurality of channel signals from the combiner (block 3 in figure 1).

It is desirable to include an equalizer for receiving the plurality of channel signals from the combiner provide diversity gain as well as to improve signal to noise ratio. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to an equalizer for receiving the plurality of channel signals from the combiner as taught by Koch into the system as taught by Rashid-Farrokh, Smolyar, Song, and Smart to improve the transmission quality (column 2, lines 7-8).

(2) with regard to claim 26:

Koch further teaches the equalizer includes a vector line for accepting output samples from the plurality of matched filters, the equalizer further for estimating a complex channel gain for each of the plurality of channels based on the accepted output samples (see figure 1).

(3) with regard to claim 28:

Song further teaches the symbol synchronizer is further for adaptively updating a convergence rate (column 16, lines 32-44)

#### ***Allowable Subject Matter***

7. Claims 15 -17, 21, 24, 25, 27, and 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The present invention comprises the symbol synchronizer is for providing a variable step size parameter to the equalizer according to a confidence measure of correct symbol boundary estimation. The prior arts teach the similar system with the symbol synchronizer but fail to teach the synchronizer is for providing a variable step size parameter to the equalizer according to a confidence measure of correct symbol boundary estimation.

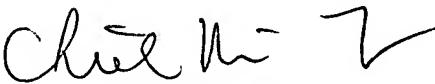
***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julia P. Tu whose telephone number is 571-270-1087. The examiner can normally be reached on 7:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on 571-272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

J.T.  
02-01-2007

  
CHIEH M. FAN  
SUPERVISORY PATENT EXAMINER